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ABSTRACT

A curriculum alignment chart is presented that translates mathematics goals/indicators into related vocational skills for the welding course in the secondary vocational education curriculum. The chart contains three columns that correlate (1) vocational education performance indicators, (2) vocational education competency and mathematics skill/concept, and (3) relevant mathematics competency indicators. A page that corresponds to the chart provides suggestions for instructing students in the skills listed on the chart and activities that might be appropriate. These activities may be sample test items and/or practical applications of skills learned. (YLB)

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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 003 01. Adjust regulators and guages to the correct PSI of gases that are to be mixed together. 02. Determine amounts of gases to be used for different cutting tip sizes.	003 Use oxyacetylene torch. SKILLS: Measure - capacity (PSI) Read -decimals Compare - decimals Measure - customary units	GRADE 7 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.03 Determine capacity by measureing quantities of liquids in metric cups or liters, or appropriate customary units. GRADE 8 2.01 Read and write numbers with as many as three decimal places 6.03 Determine capacity (liquid measure) by measuring quantities of liquids in metric spoons, metric cups or liters, or appropriate customary units HEATH LEVEL 2 9-4 Measure using the customary system.

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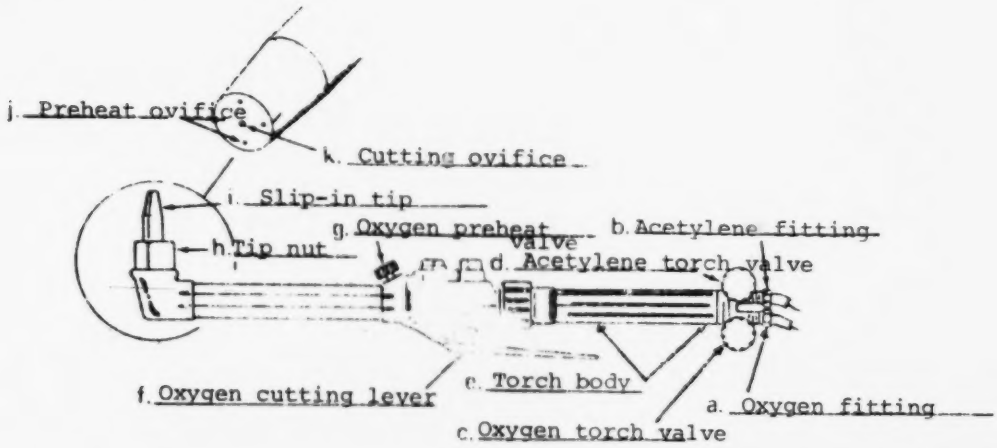
VOCATIONAL EDUCATION COURSE Welding

003

INSTRUCTIONS TO STUDENTS: Identify the parts of the torch body and cutting attachment.



INSTRUCTIONS TO STUDENTS: Place a X in the space to the left of the best answers.

1. The purpose of the mixing head in the torch body is to combine the two welding gases into a usable combination. Which statements below are reasons why?

__X__ A. The amount of mixed oxygen and acetylene is only that amount contained from the mixing head to the tip orifice.

__X__ B. It represents a very small portion of a cubic inch.

__X__ C. An attempt to mix greater amounts than a cubic inch may result in a violent explosion.

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to turn on, light, adjust, and turn off the oxyacetylene torch.

Tools and equipment needed:.
A. Oxyacetylene welding equipment
B. Welding goggles
C. Flint lighter
D. Welding gloves.

CURRICULUM ALIGNMENT CHART

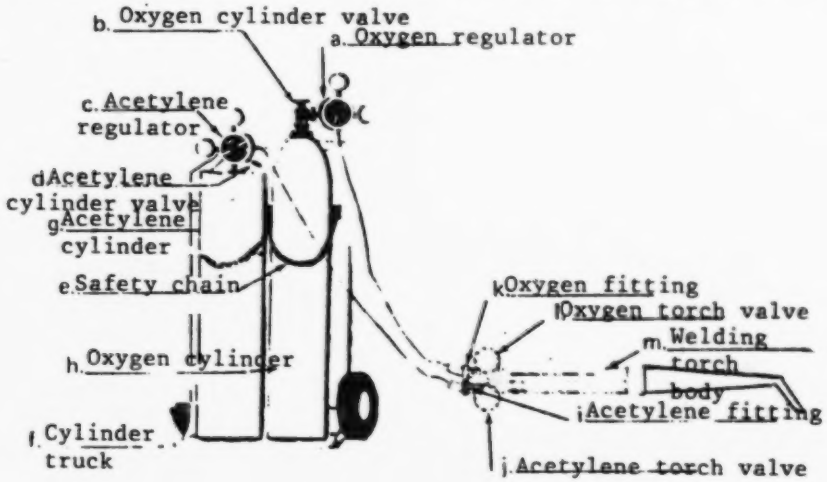
VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 005 01. Adjust regulators and guages to the correct PSI of gases that are to be mixed together. 02. Determine the amounts of gases to be used for different welding tip sizes. 03. Select the correct size welding tip for a given job. 04. Select correct amounts of gases to be used. 05. Identify different sizes of metal. 06. Determine the sizes of filler rod to be used on different sizes of metal.	005 Demonstrate the process of oxyacetylene welding. SKILLS: Read - decimals Compare decimals Measure - capacity Measure - customary units Read - fractions Read - scales and measurements	GRADE 7 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.03 Determine capacity by measuring quantities or liquids in metric cups or liters, or appropriate customary units GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators 6.03 Determine capacity (liquid measure) by measuring quantities of liquids in metric spoons, metric cups or liters, or appropriate customary units. HEATH LEVEL 2 9-4 Measure using the customary system.

005: INSTRUCTIONS TO STUDENTS: Demonstrate the ability to turn on, light, adjust and turn off welding equipment.

Tools and Equipment Needed
- A. Oxyacetylene welding unit
- B. Welding tip
- C. Protective equipment
- D. Flint lighter

INSTRUCTIONS TO STUDENTS: Identify the following oxyacetylene fusion welding equipment.



Construct beads on metal without filler rod.
Construct a corner weld without filler rod.
Construct a dege weld without filler rod.
Construct a lays weld without filler rod.

Construct beads on meatal with filler rod.
Weld butt joints with filler rod.
Describe the purpose of the filler rod.

Weld all joints in different positions with filler rod
- (1) LAP
- (2) EDGE
- (3) BUTT
- (4) FILLET

TEST ITEM 005-01-13

INSTRUCTIONS TO STUDENTS: Define the following terms:

A. Tack Weld - A short weld used for temporarily holding material in place

B. Fusion Welding - Joining of pieces of metal by heating the adjoining edges to the fusion or meting point and allowing them to flow or run together and then cool.

C. Penetration - Distance from the original surface of the base metal to that point at which fusion ceases

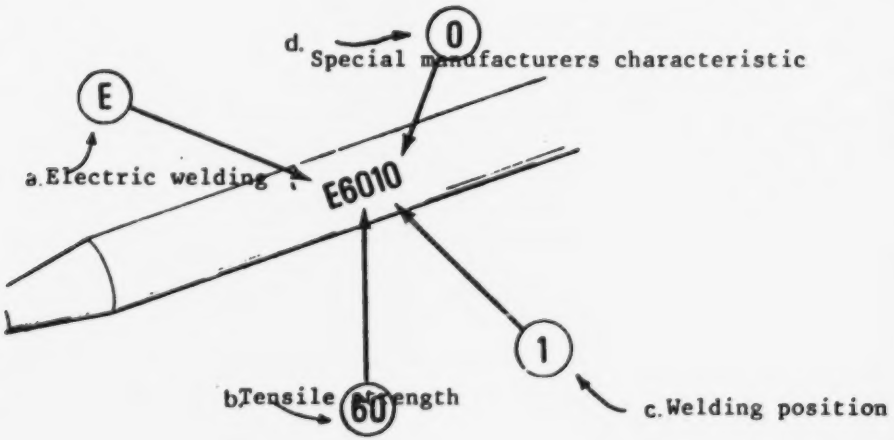
VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 007 01. Correctly use A.W.S. electrode classification. 02. Determine electrode size. 03. Correctly use dials, scales, guages on machines. 04. Identify sizes of cables, electrode handles, welding machines, and ground clamps. 05. Determine size of metal to be welded. 06. Determine angles of electrode.	007 Describe the principles of arc welding. SKILLS: Measure - customary units Read - fractions Measure - using ruler Read - tables and charts	GRADE 7 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 7.02 Determine length, width, or height by measuring an object or drawing to the nearest centimeter, meter, or appropriate customary unit 8.02 Interpret information contained in tables, charts, and diagrams GRADE 8 3.01 Read and write fractions with more commonly used denominators INTRODUCTORY ALGEBRA (PART ONE) 10.05 Find the measure of one of the angles of a triangle, given the measure of the two other angles GENERAL MATHEMATICS 11.01 Use the addition property of equality to solve a linear equation HEATH LEVEL 2 9-4 Measure using the customary system. HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler.

VOCATIONAL EDUCATION COURSE Welding

007 Describe principles of arc welding
Identify and describe the parts and functions of the electric arc welding units.
Identify and select electrodes properly
Name types of electrodes
Determine sizes of electrodes
Get up, adjust and shut down the arc welding unit
Proper angle of electrode
Correct electrode and size
Correct machine adjustment
Correct arc length

INSTRUCTIONS TO STUDENTS: Identify the parts of the electrode in the drawing below:



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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 009 01. Measure and layout specimen as indicated. 02. Adjust and set regulators, gases on oxyacetylene correctly as to thickness of metal and tip size. 03. Make correct angles of bevel, root face, spacer, penetration, electrode angle. 04. Use correct electrode size for current, amperage, and thickness of metal. 05. When flame cutting, allow enough metal for finished size after grinding of 1 1/2" width and a minimum of 6" length. 06. A radius of 1/16" should be ground on all four corners running the full length of the coupon. 07. Cut coupon exactly as marked out by flame cutting. 08. The weld shall contain no gas pockets, oxide particles, or slag inclusion exceeding 1/8" in greatest dimension. Also no square inch of weld metal area shall contain more than 6 gas pockets exceeding 1/16" in greatest dimension. 09. The tensile strength shall not be less than 100% of the minimum of the specified tensile range of the base material used.	009 Layout, cut, and prepare coupons. SKILLS: Measure - customary units Read - scales Read - ruler Read - fractions Measure - angles Read - decimals	GRADE 7 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.02 Determine length, width, or height by measuring an object or drawing to the nearest centimeter, meter, or appropriate customary unit GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators INTRODUCTORY ALGEBRA (PART ONE) 10.05 Find the measure of one of the angles of a triangle, given the measure of the two other angles GENERAL MATHEMATICS 9.04 Locate the graph of an integer on the number line HEATH LEVEL 2 9-4 Measure using the customary system. HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler.

SHIELDED METAL ARC WELDING
POSITION WELDING
UNIT II

WELD TESTING-LAY OUT, CUT, AND PREPARE COUPONS

Equipment and materials

A. Lay out tools
   1. Soapstone
   2. Steel rule
   3. Steel number and letter stencils
   4. Hammer

B. Power hacksaw

C. Milling machine (if available)

D. Oxyacetylene cutting unit

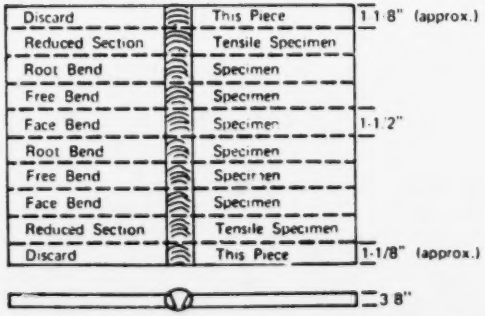
E. Grinder, portable right angle and pedestal

F. Protective equipment

II. Procedure

A. Lay out test plate as indicated in Figure 1

FIGURE 1



B. When flame cutting, allow enough metal for finished size after grinding or machining of 1 1/2" width and a minimum of 6" in length

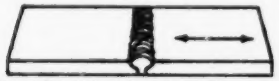
(NOTE: At no time shall coupon be cooled rapidly as this may cause failure when tested.)

C. For best test results, the coupon should be finished in the following manner for root and face bend

1. Grind to a smooth flush finish

(NOTE: Grind marks should run the length of the coupon, not across.) (Figure 2)

FIGURE 2



Grind Parallel to Length of Test Strips

2. A slight radius should be ground on all four corners running the full length of coupon. A 1/16" radius is maximum (Figure 3)

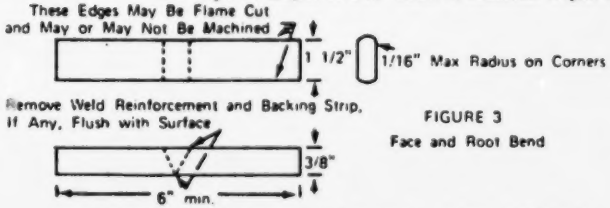
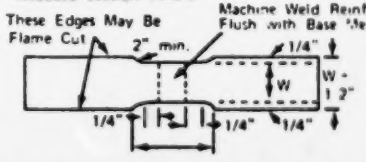

These Edges May Be Flame Cut
and May or May Not Be Machined
1 1/2"
1/16" Max Radius on Corners
Remove Weld Reinforcement and Backing Strip,
If Any, Flush with Surface
3/8"
6" min.

FIGURE 3
Face and Root Bend

D. Reduced section tensile is cut and prepared as indicated (Figure 4)

FIGURE 4
Reduced Section Tensile



Tensile Strength Shall Not Be Less Than the Minimum Specified Tensile Strength of the Base Metal Used (May Break in the Weld)

w = 1 1/2" if t ≤ 1"

w = 1" if t > 1"

Reduced Section Machined Preferably By Milling

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CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 010 01. Select and adjust correct current settings for different metals. 02. Read and regulate the flow or argon or helium gas used in G.T.A.W. 03. Use correct size of tungsten and collet for the weld being performed. 04. Use the correct size of filler rod for a given job. 05. Adjust and set scales, dials, and gaugaes on G.T.A.W. machine. 06. Determine type and thickness of metal to be welded. 07. Adjust flowmeter to the correct cubic feet per hour of argon. 08. Demonstrate the ability to set up and shut down the G.T.A.W. process of welding aluminum.	010 Describe the principals of gas tungsten arc welding (G.T.A.W.). SKILLS: Measure - customary units Measure - angles Read - fractions Read - decimals Measure - using ruler	GRADE 7 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.02 Determine length, width, or height by measuring an object or drawing to the nearest centimeter, meter, or appropriate customary unit GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators INTRODUCTORY ALGEBRA (PART ONE) 10.05 Find the measure of one of the angles of a triangle, given the measure of the two other angles GENERAL MATHEMATICS 9.04 Locate the graph of an integer on the number line HEATH LEVEL 2 9-4 Measure using the customary system. HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler.

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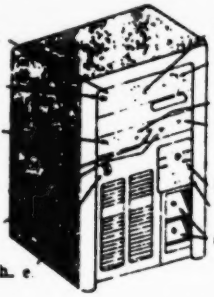
VOCATIONAL EDUCATION COURSE Welding

010-

INSTRUCTIONS TO STUDENTS: Identify the major controls of the G.T.A.W. power supply from the drawing below:



Remote Control Switch a.
Remote Control receptacle b.
Gas afterflow timer c.
Weld control switch f
High frequency spark switch g
Power Switch e.

a. Fine adjustment current control
b. Polarity switch
c. Soft start
d. High frequency spark intensity
e. Current range selector
f. Gas and water connections
g. Ground and electrode terminals

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to set up, start and shut down the G.T.A.W. process for welding steel.

Equipment and Materials Needed

A. G.T.A.W. power supply with water cooled torch with or without foot control.
B. Argon - Shielding gas
C. 1-2% thoriated tungsten
D. Collet and collet chuck (body)
E. Correct nozzle size
F. Stainless and mild steel filler rod

INSTRUCTIONS TO STUDENTS: Select five advantages of the G.T.A.W. process from the following examples. (Place a "X" by the correct example.)

___A. Slag and spatter easily removed.

_X_B. Welder has very close control of welding current.

_X_C. Arc and weld puddle clearly visible to welder.

___D. Welding speeds are much faster than the GMAW process.

_X_E. Minimum of distortion and stress with heat concentrated in a small area.

_X_F. No flux used and no post cleaning required.

_X_G. Makes excellent root pass on carbon and stainless steel pipe.

___H. Used exclusively on heavy plates where rapid production is necessary.

___I. Lends itself to assembly line use in the auto industry.

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 011 01. Select proper current. 02. Adjust flowmeter to the proer cubic feet per hour of argon or CO_2. 03. Select correct size filler wire. 04. Select correct voltage setting. 05. Select correct size metal. 06. Adjust and maintain correct stick out. 07. Set wire speed controls correctly.	011 Describe the principles of gas metal arc welding (G.M.A.W.). SKILLS: Measure - customary units Measure - angles Read - fractions Read - decimals Measure - using ruler Read - scales	GRADE 7 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.02 Determine length, width, or height by measuring an object or drawing to the nearest centimeter, meter, or appropriate customary unit GRADE 8 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators INTRODUCTORY ALGEBRA (PART ONE) 10.05 Find the measure of one of the angles of a triangle, given the measure of the two other angles GENERAL MATHEMATICS 9.04 Locate the graph of an integer on the number line HEATH LEVEL 2 9-4 Measure using the customary system. HEATH LEVEL 6 9-6 Measure lengths with a 1/16-inch ruler.

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VOCATIONAL EDUCATION COURSE Welding

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to make a butt weld in the horizontal and vertical positions.

Equipment and Materials Needed

A. G.M.A.W. power supply, wire feeder, and air cooled gun for short arc application
B. Shielding gas CO_2 or C-25 at 20 c.f.h. (25% - CO_2; 75% argon)
C. Electrode filler wire - .035 diameter A.W.S. #E705-3
D. Current setting - DCRP 110-120 amps (wire feed speed)
E. Voltage setting 16-10 arc volts
F. Material - 2 pieces mild steel 3/16" x 3" x 6"
G. Personal protective equipment

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to weld beads with flux-cored wire.

Equipment and Materials Needed

A. G.M.A.W. power supply, wire feeder, and air cooled gun for flux cored application
B. Shielding gas CO_2 at 35-40 c.f.h.
C. Electrode filler wire - 1/16" diameter A.W.S. #E70T-
D. Current setting - DCRP 175-300 amps (wire feed speed)
E. Voltage setting 25-30 arc volts
F. Material - 2 pieces mild steel 1" x 2 1/2" x 8"
(Note: Several sizes of metal can be substituted here.)
G. Personal protective equipment
(Caution: Adequate ventilation is absolutely necessary due to excessive smoke produced with flux cored process.)
H. Steel wire brush
I. Slag hammer

INSTRUCTIONS TO STUDENTS: Match the shielding gases to their user(s).

2	A. Used to weld aluminum and magnesium	1. Argon - CO_2
3	B. Used to weld heavy sections of aluminum	2. Argon
1 & 4	C. Used to weld mild and stainless steel	3. Argo-Helium
5	D. Used for mild steel with short arc and and flux cored application	4. Helium; Argon; CO_2
6	E. Used on mild, stainless, and alloy steels and copper alloys	5. CO_2
		6. Argon-Oxygen

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to make fillet welds in any position.

Equipment and Material

A. G.M.A.W. power supply, wire feeder and air cooled gun for short arc application.
B. Shielding gas CO_2
C. Electrode filler wire - .035 diameter A.W.S. #E705-3
D. Current setting - DCRP 140-160 amps (wire feed speed)
E. Voltage setting 10-21 arc volts
F. Material - 2 pieces mild steel 3/16" x 3" x 6"
G. Personal protective equipment

CURRICULUM ALIGNMENT CHART

VOCATIONAL EDUCATION COURSE Welding

VOCATIONAL EDUCATION PERFORMANCE INDICATOR	VOCATIONAL EDUCATIONAL COMPETENCY MATH SKILL/CONCEPT	RELEVANT MATH COMPETENCY INDICATORS
INDICATORS 012 01. Correct setting and operation of welding machines. 02. Correct use of shielding gas. 03. Correct pipe and electrodes. 04. Bevel pipe at the correct angle.	012 Prepare and task pipe workpieces. SKILLS: Measure - customary units Measure - angles Read - fractions Read - decimals Measure- using ruler Read - scale	**GRADE 7** 3.01 Read and write fractions with more commonly used denominators 3.16 Use <, >, or = to compare two fractions 4.01 Read and write decimals through thousandths 4.03 Use <, >, or = to compare two decimals 7.02 Determine length, width, or height by measuring an object or drawing to the nearest centimeter, meter, or appropriate customary unit **GRADE 8** 2.01 Read and write numbers with as many as three decimal places 3.01 Read and write fractions with more commonly used denominators **INTRODUCTORY ALGEBRA (PART ONE)** 10.05 Find the measure of one of the angles of a triangle, given the measure of the two other angles **GENERAL MATHEMATICS** 9.04 Locate the graph of an integer on the number line **HEATH LEVEL 2** 9-4 Measure using the customary system. **HEATH LEVEL 6** 9-6 Measure lengths with a 1/16-inch ruler.

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VOCATIONAL EDUCATION COURSE Welding

012-

INSTRUCTIONS TO STUDENTS: Select the correct height of the reinforcement of the cover pass on a pipe joint from the following.

A. 3/8 inch

B. 1/4 inch

C. Flat with the surface

(D.) 1/16"

INSTRUCTIONS TO STUDENTS: List the five basic joints used in the gas tungsten arc welding of pipe.

Standard V-Joint
Sharp V-Joint
U-groove joint
Consumable insert joint
Rolled-edge joing

INSTRUCTIONS TO STUDENTS: Demonstrate the ability to tack the pipe joint and weld the pipe in each of the three ways described below.

A. Start the bead at the top and carry it down to the bottom center. Then weld the other side, starting again at the top center and welding downward to the bottom.

B. Start the weld at the bottom and work upward, first on one side and then on the opposite side.

C. Start the weld on the top and carry completely around.

Equipment and Mat rials Needed

A. Welding machine
B. shielding gas
C. Protective equipment
D. E-6010 electrodes
E. Light wall pipe; Heavy wall pipe
F. Beveled pipe

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